# 26 Representation and Interpretation of Data

After studying this chapter you will be able to get a good understanding of each of the following.
★ Identifying the concepts of bar graphs, multi-bar graphs, stem and leaf diagram and the representation of given data by these methods.
★ Writing the range by identifying the least value and the greatest value of a group of data.
★ Analyzing data represented by various methods, and thereby facilitating day- to -day activities.

## 26.1  Bar graphs

A graph similar to what you have learned in Grade 6 is given below. Study it and try to answer the given questions.

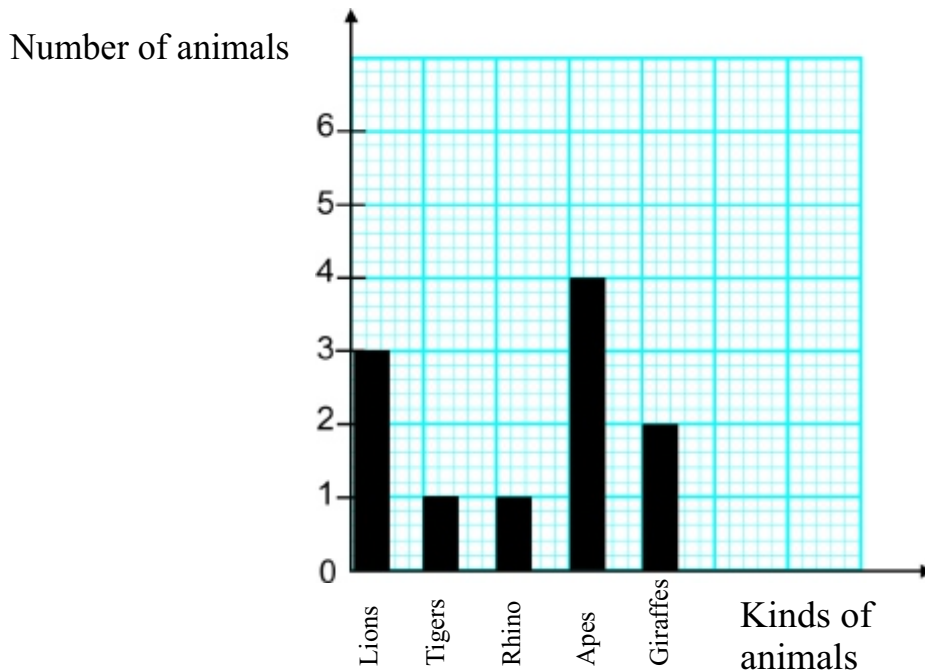The following represents the number of animals shani saw in a zoo.

Lions

Tigers

Rhino

Apes

Giraffes
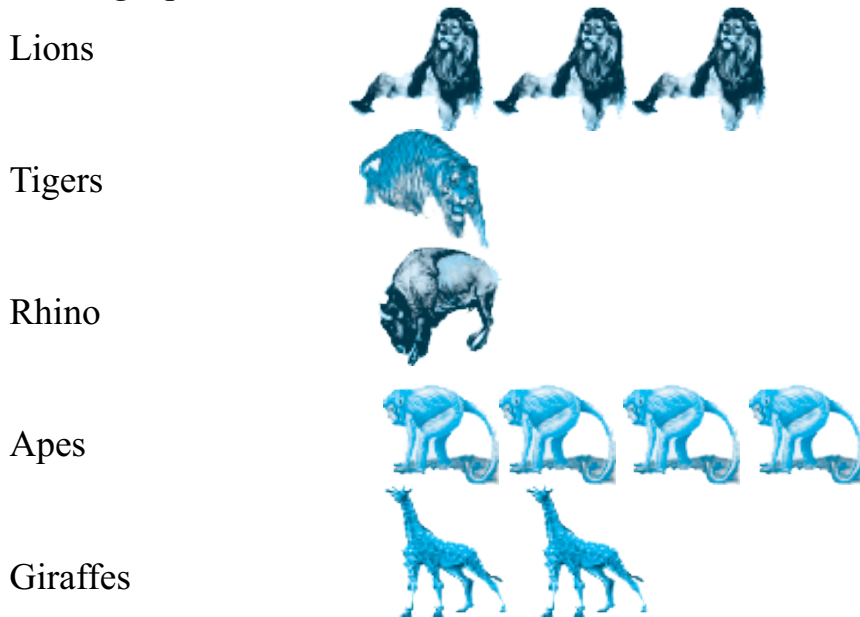
(Here one figure represents one animal.)

(i)    How many lions did she see ?

(ii)   What animal did she see most ?

(iii)  What is the total number of animals she saw ?

(iv)   What is the name of this kind of graph ?

(v)    Propose what can be done to represent the information if the number of animals was very much more than this.

Let us identify **bar graphs** as a method of representing such information without drawing pictures.

> In occasions such as this, the quantities of data that have to be represented are presented by means of bars. This type of a graph is called a bar graph.

Let us represent the information given by the above picture graph by a bar graph.



Number of animals

Find the height of the rectangle which represents the relevant animal by looking at the number on the vertical axis. Accordingly, the following information can be noted.

- Three lions
- One rhino
- One tiger
- Two giraffes
- Four apes
- Apes; the animal that Shani saw most are apes. It is four.

> Normally in a bar graph, the kind of information that has to be represented is given by the horizontal axis and the numbers by the vertical axis.

**Example 1**

The results Suboda obtained by collecting information about the day of birth of each pupil in Grade 7 are as follows.

| Day of birth | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|---|---|---|---|---|---|---|---|
| Number of children | 5 | 7 | 4 | 6 | 2 | 4 | 1 |

Represent this information by a bar graph. Using the graph answer the following questions.

(i) What is the day on which the least number of children in this class were born?

(ii) What is the day on which the most number of children were born ?

(iii) On what days where an equal number of children were born?

(iv) What is the total number of children in Grade 7 of the school? Compare your graph with the given bar graph.
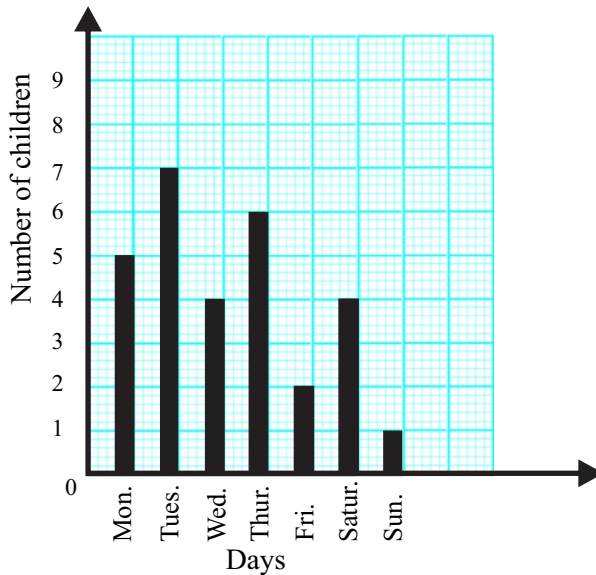
According to the above graph,

(i)     the least number of children were born on a Sunday.
(ii)    the most number of children were born on a Tuesday.
(iii)   an equal number of children were born on Wednesdays and Saturdays.
(iv)    The total number of children in Grade 7

$$= 5 + 7 + 4 + 6 + 2 + 4 + 1 = 29$$

Now you have drawn a bar graph relevant to the given information. Let us inquire by the next activity as to how a bar graph can be drawn after finding the data needed and tabulating them.

## Activity 26.1

The number of books the children of a few classes obtained from the government are given in the figure. A few children, Amal (A), Kamal (K), Ranil (R), Upul (U) and Wipul ( W) have written only the first letter of their names on their books.
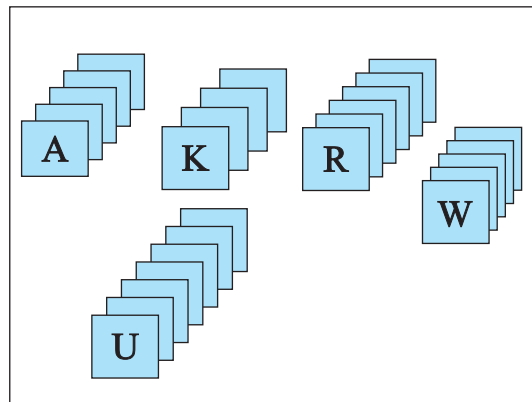
Complete the following table using the information in the figure on the page 121.

| Name of the child | Amal | Kamal | Ranil | Upul | Wipul |
|---|---|---|---|---|---|
| Number of books | | | | | |

Draw a bar graph to represent the information in this table. (Use a square ruled paper for this). Answer the following questions using the graph.

(i) How many books has Amal received?

(ii) Who are the children who have received an equal number of books?

(iii) What is the total number of books the government has given to these five children?

(iv) Shade the columns representing the least number of books and the most number of books and find the difference between them. What does this difference represent?

## Exercise 26.1

(1) The earthquake which brought the Tsunami disaster to Sri Lanka on the 26th of December 2004 was recorded on the Richter scale as 9.2. The places in which a few such earthquakes have occurred and the strength recorded are as follows.

| Place | Mesina | Italy | Kuwait | Andaman Islands | Sumatra |
|---|---|---|---|---|---|
| Strength of the quake | 8 | 7 | 6 | 9 | 9 |

Represent this information in a bar graph. Using it, answer the following questions.
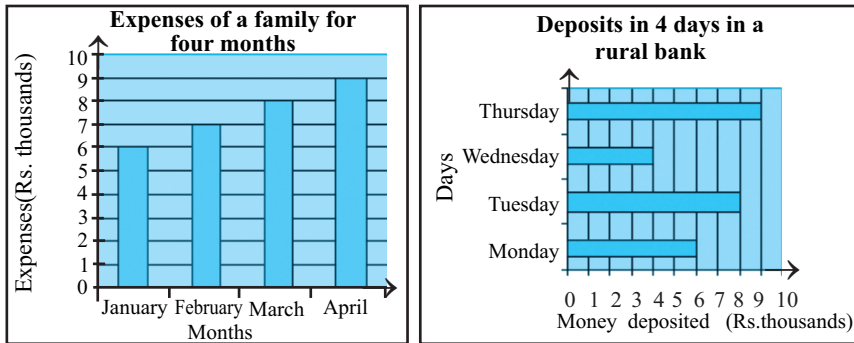
(i) Shade the column representing the strongest quake in red and the column representing the weakest earthquake, in yellow.

(ii) What are the two places where earthquakes of equal strength occurred ?

(iii) How many units is the strength of the earthquake in Kuwait?

(iv) Select the place having the least danger to live in, if these earthquakes happen in the future with the same strengths.

(2)    A bar graph drawn showing the preference of the children in a class for five kinds of drinks is given below. Study the graph and answer the following questions.
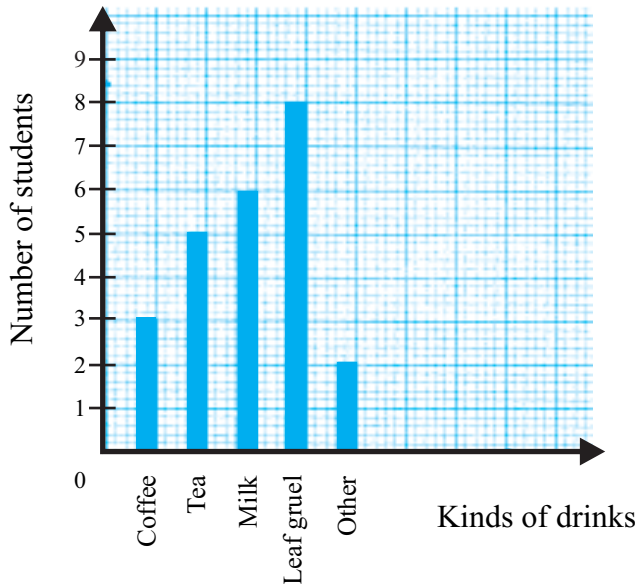


(i)    What information is represented by each axis of this graph?

(ii)   Which of the drinks, out of tea , milk and coffee do the children like most?

(iii)  Find separately the number of students who like to drink each kind of drink.

(iv)   Fill in the blanks of the following sentences.
       (a) .......................... children prefer leaf gruel to coffee.

       (b)  The difference between the number of children who like to drink tea and the number of children who like to drink milk is ............................. .

       (c)  According to the preference of the children it is more suitable to prepare the drink ..................... .

(3)    Study the following two bar graphs well.



**Expenses of a family for four months** (vertical bar graph, Expenses(Rs. thousands) vs Months: January, February, March, April)

**Deposits in 4 days in a rural bank** (horizontal bar graph, Days: Monday, Tuesday, Wednesday, Thursday vs Money deposited (Rs.thousands))

Given above are two bar graphs drawn in two methods. Study the two graphs well and write five features seen in them.

In a bar graph,  the  bars  are rectangular and they can be either horizontal or vertical. Also they should not touch each other. The breadth of the bars is equal and the gaps between the bars is also equal.

## 26.2 Multi-bar Graphs

In situations when the information  of the same category is different, it cannot be represented by one column. Let us now study , how **multi-bar graphs** are drawn in such situations.

### Example 2

The  information  extracted  from  a  daily  attendance  register  of  the students of a school about the absentees during one week is given below.

| Day \ Students | Mon | Tue | Wed | Thu | Fri |
|---|---|---|---|---|---|
| Boys | 3 | 5 | 1 | 4 | 4 |
| Girls | 4 | 3 | 1 | 0 | 4 |

124                                                          Free Distribution

The multi-bar graph representing this information is given below. In it the mark ▢ is used for boys and the mark ■ for girls and this is shown on the right side of the graph as a key.



**The number of girls and boys absent on the five days of a week.**
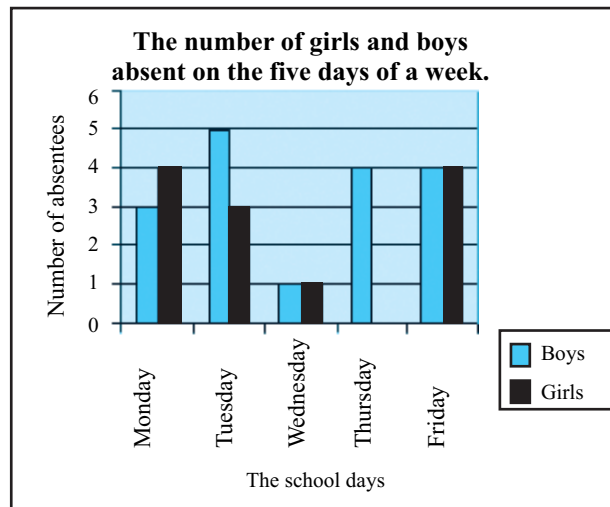
Study the above graph and answer the following questions .

(i) What is the day on which the most number of boys were absent?
This is Tuesday, The tallest bar for boys is on Tuesday.

(ii) Find separately the number of boys and girls absent on all five days.
▢ This sign indicates the absence of boys.
$$= 3 + 5 + 1 + 4 + 4 = 17$$
■ This sign indicates the absence of girls.
$$= 4 + 3 + 1 + 0 + 4 = 12$$

(iii) There is no bar representing girls on Thursday. Explain the reason for it? All girls were present on that day.

(iv) What is special about the presence of students on Wednesday and Friday? An equal number of boys and girls were absent.

(v) What is the difference between bar graphs and multi-bar graphs?
In a bar graph, only one kind of information of a category is represented while in a multi-bar graph there is more than one type of information represented.

## Exercise 26.2

(1) Observe the graph given below and answer the questions.
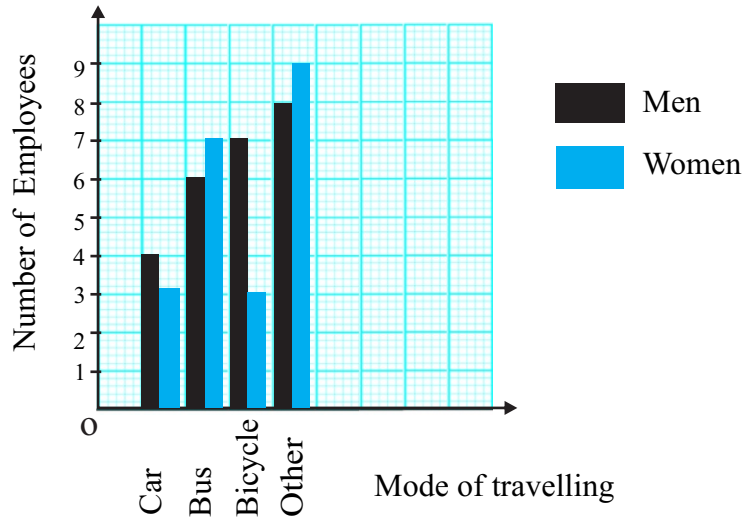


(i)    What is the information represented in this graph?

(ii)    What is the total number of employees coming by bus?

(iii)    How do the least number of employees come?

(iv)    How do the most number of employees come? What is the difference between the number of men and the number of women who use this mode of travelling?

(2)    Find the number of boys and girls in each of the Grades 1 - 7 in your school and tabulate them suitably. Represent all that information by a multi-bar graph. Answer the questions on the next page using that graph.

(i) Find seperately the total number of boys and the total number of girls.

(ii) Out of the boys and girls in Grades 1 to 7, who are more in numbers, girls or boys?

(iii) Find the difference between the number of girls and the number of boys in each class.

(iv) State two things you think about the benefits of multi-bar graphs.

## 26.3 Stem and Leaf Diagram

The marks obtained by 30 pupils for one subject in Grade 7 are given below.

| 62, | 26, | 39, | 55, | 60, | 47 |
| 27, | 35, | 69, | 48, | 30, | 48 |
| 52, | 57, | 42, | 61, | 21, | 59 |
| 56, | 20, | 12, | 17, | 20, | 18 |
| 30, | 33, | 44, | 51, | 61, | 10 |

The above numbers are not arranged in any order.

Let us study about the **stem and leaf diagram** as a method that can be used to arrange such numbers, in ascending order or in descending order.

### Example 3

Let us prepare a chart as below to arrange the above marks in order.

| | Stem | leaf |
|---|---|---|
| Tens ⟶ | 1 | ............ |
| Twenties ⟶ | 2 | ............ |
| Thirties ⟶ | 3 | ............ |
| Forties ⟶ | 4 | ............ |
| Fifties ⟶ | 5 | ............ |
| Sixties ⟶ | 6 | ............ |

Since the marks spread only from tens to sixties, only those are included in the left column. Two more rows could be added to this if there

were marks less than 10; as "units" to start with, and if marks from 70 - 79 were there, then as "seventies" at the end. Let us write the above marks in this chart. Numbers in the tenth place are the stems and numbers in the unit place are the leaves. When the given marks are entered in this chart in order you will get the following chart.

| Stems | Leaves |  | Stem | Leaves |
|-------|--------|--|------|--------|
| 1 | 2, 7, 8 , 0 | When | 1 | 0, 2, 7, 8 |
| 2 | 6, 7, 1, 0, 0 | they are | 2 | 0, 0, 1, 6, 7 |
| 3 | 9, 5, 0, 0, 3 | arranged | 3 | 0, 0, 3, 5, 9 |
| 4 | 7, 8, 8, 2, 4 | in | 4 | 2, 4, 7, 8, 8 |
| 5 | 5, 2, 7, 9, 6, 1 | asending | 5 | 1, 2, 5, 6, 7, 9 |
| 6 | 2, 0, 9, 1, 1 | order | 6 | 0, 1, 1, 2, 9 |

Now let us consider how this chart can be obtained.

★ Cut off the first number 62 in the list of marks by a line as 6/2 and write 2 in the 6th row of the leaf column.

★ Secondly cut off the second number 26 in the list of marks as 2/6 and write 6 in the 2nd row of the leaf column.

When entering 26 in the stem and leaf diagram, only 6 is entered in the leaf column, since 26 $\longrightarrow$ 20 + 6, By entering the other marks too in the same way, the above chart can be obtained.

★ In a **stem and leaf diagram**, data not previously arranged in an order are divided as stems and leaves, considering the place value of the numbers, and arranged in ascending order.

When the second row of numbers of the above stem and leaf diagram is considered "2" is the stem and 0, 0, 1, 6, 7 are the leaves. Let us represent it by a figure as shown here.

Leaves

Stem (2)
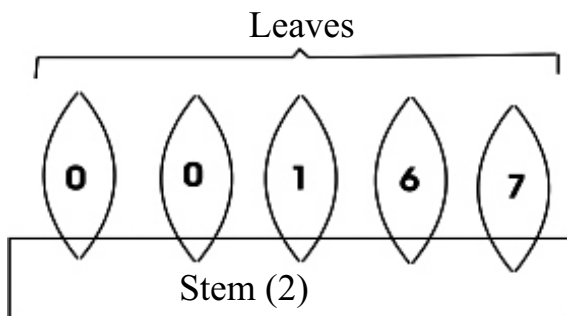
★ Since data can be represented as a stem and leaves as above, it is known as a **stem and leaf diagram**. By observing this, solutions to problems can be obtained.

Activity 26.2

Ayesha measured the height of the flower plants in her flower bed in centimetres and collected them as shown below.

06  12  18  47  12  07  26  29  43  05  33  38  44  16  25
31  48  15  09

Enter this set of numbers in the following charts.

| stem | leaf |
|------|------|
| 0 | 6, 7, 5, 9 |
| 1 | 2, 8, .... |
| 2 | ............ |
| 3 | ............ |
| 4 | ............ |

When these are arranged in ascending order →

| stem | leaf |
|------|------|
| 0 | ......... |
| 1 | ......... |
| ... | ......... |
| ... | ......... |
| ... | ......... |

Example 4

What is given below is the information obtained by measuring to the nearest centimetre, the height of a group of students in a certain Grade.

135, 135, 137, 139, 136, 143, 145, 150, 148, 141, 150, 157, 140, 153, 154, 138, 137, 159, 153, 152

Represent this information by a stem and leaf diagram.
You would have seen some difference in this information. That is, these numbers are three digit numbers. Let us find out how these can be represented in a stem and leaf diagram.

These values can be separated into three groups according to the first two digits.

| Group 1 | 135, 135, 137, 139, 136, 138, 137 |
|---------|-----------------------------------|
| Group 2 | 143, 145, 148, 141, 140 |
| Group 3 | 150, 150, 157, 153, 154, 159, 153, 152 |

Let us now represent this data by a stem and leaf diagram.

| Stem | Leaf |
|------|------|
| 13 | 5, 5, 6, 7, 7, 8, 9 |
| 14 | 0, 1, 3, 5, 8 |
| 15 | 0, 0, 2, 3, 3, 4, 7, 9 |

In a case like this, the unit values are considered as leaves, and the number formed by the other two digits as the stem.

### Exercise 26.3

(1) Enter the following marks in a stem and leaf diagram.
   87, 25, 58, 77, 45, 13, 23, 34, 21, 89, 67, 17, 18, 24, 45, 53, 40, 25, 44, 33, 18, 60

(2) The Mathematics teacher prepared a Mathematics question paper with 40 marks as the total. A group of students who answered that paper obtained the following marks.
   18, 29, 20, 40, 08, 14, 37, 33, 28, 27, 19, 28, 11, 37, 26, 24, 27, 35, 36, 34

Represent these marks in a stem and leaf diagram and answer the following questions.

      (i)     How many students are there in the group?

      (ii)    What is the maximum mark and the minimum mark of the group?

      (iii)   According to these marks, write two observations about the mathematical skills of the group.

(3)    The teak cultivation, Sunil started in the back yard of his house was improving daily. One day he decided to measure the height of each of the teak plants. Accordingly, the height of the teak plants he measured to the nearest centimetre is as follows.

211, 215, 213, 220, 216, 233, 227, 243, 231, 244, 240, 210, 212, 223, 246, 250, 238, 229, 230, 224

Represent this data in a stem and leaf diagram.

## 26.4 Spread of data

We learned a few methods of representing data, in the above lessons. From these representations further information could be obtained about them. Let us study how data are spread to fulfil this aim.

## Example 5

Kelum has written a part of his daily routine with the time on a number of cards. Look at the cards on the next page in the written order. Make an effort to arrange them in order.
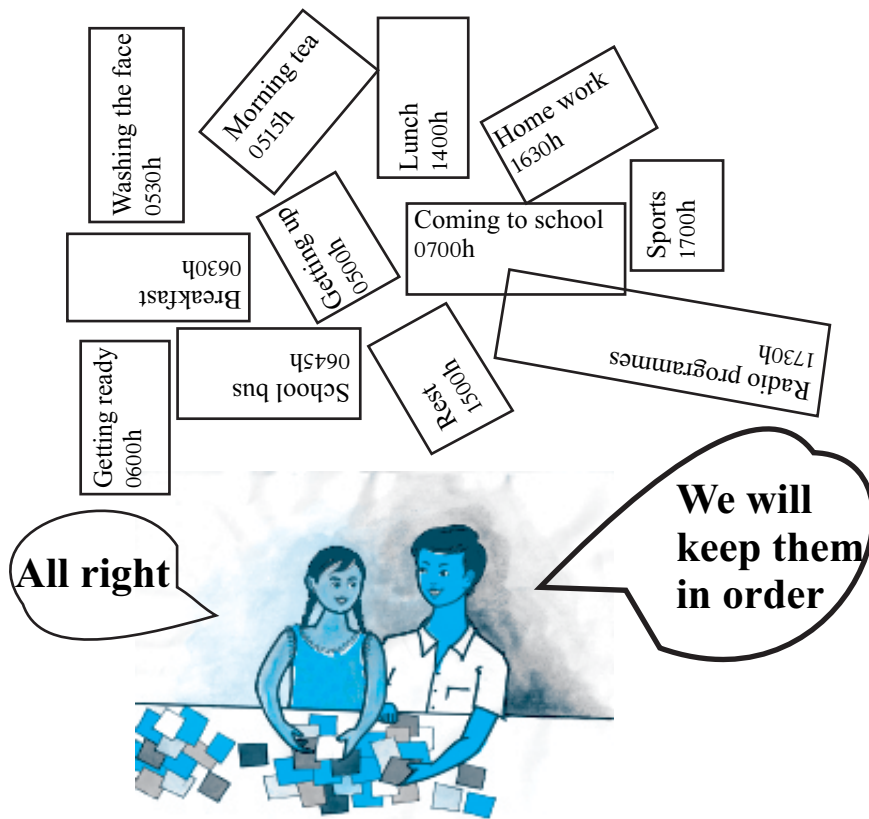
If Kelum to get benefit from this effort, the cards should be arranged in order such as getting up in the morning, having morning tea, washing the face ..., etc. Similarly by arranging the numerical data obtained also in some order, important information can be obtained from it. Let us investigate about it.

**Example 6**

The number of students in each class of a school from Grades 1 - 11 is given below.

33, 32, 31,30, 36, 29, 28, 27, 28, 26, 22

Arrange this data in order and answer the following questions.
(i)     What is the minimum number of students in a class?
(ii)    What is the maximum number of students in a class?

(iii)    What is the difference between the maximum and the minimum number of students?

First we arrange this data in order.
22, 26, 27, 28, 28, 29, 30, 31, 32, 33, 36
According to the above arrangement, the following answers could be obtained.
(i)      Minimum number        = 22
(ii)     Maximum number        = 36
(iii)    The difference        $= 36 - 22 = 14$

**Example 7**

A stem and leaf diagram prepared on the time ( in minutes) taken  by the students in Grade 10 of a certain school to finish a Science practical test is given below.

| Stem | Leaf |
|------|------|
| 0 | 7, 9, 9, 9 |
| 1 | 2, 2, 5, 7, 8, 8, 9, 9 |
| 2 | 0, 1, 3, 3, 5 |
| 3 | 0, 0, 1 |

Answer the following questions using the above stem and leaf diagram.
(i)      How many students have taken part in the test?
(ii)     What is the minimum time and the maximum time taken by the students for the test?
(iii)    What is the difference between that minimum time and the maximum time?

According to the information in the stem and leaf diagram,
(i)      the total number of students who took part in the test is 20.
(ii)     the minimum time is 7 minutes and the maximum time is 31 minutes.

When a given set of numbers is arranged in ascending order the last number which is the highest is called the **maximum value** and the first number which is the lowest is called the **minimum value.**

In the set of numbers arranged in ascending order, the difference between the highest and the lowest is called the **range.** Hence to find the range the minimum value has to be subtracted from the maximum value.

**Maximum value - Minimum value = Range**

**Exercise 26.4**

(1) (i) Copy the following table. According to the pattern, write whether each part is ascending or descending.

| Pattern | Ascending/ Descending |
|---|---|
| (i) o o O O O O | |
| (ii) $f\,f\,f\,f\,f\,f$ | |
| (iii) 2, 4, 6, 8, 10, 12 | |
| (iv) 50, 42, 35, 29, 24, 20 | |

(ii) In the above table, shade the minimum value in yellow and the maximum value in red.

(2) Fill in the blanks with suitable words.

(i) In a group of data ............................. value is known as .................................. and ...................... value as .............. .

(ii) To obtain ....................., .......................... value should be subtracted from .................... value.
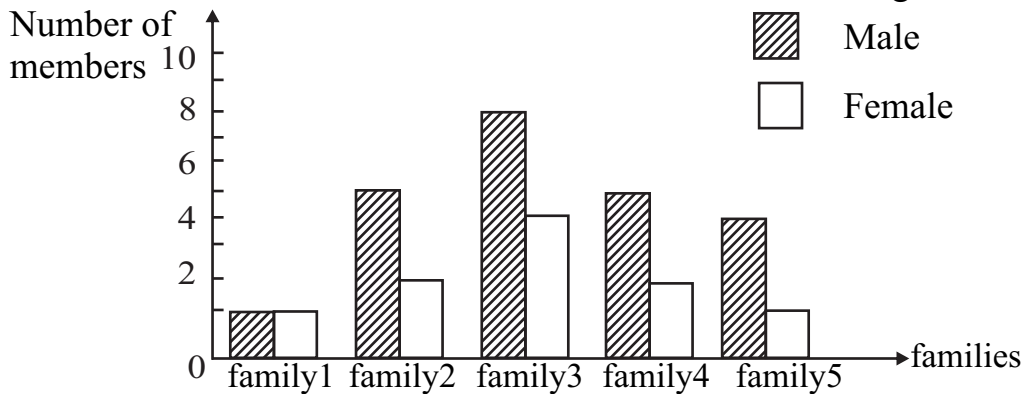
(3)    Re - arrange each of the following data in ascending order, and find the range of each.

(i) 7, 0, 1, 4, 5, 3, 9

(ii) 35, 12, 7, 13, 47, 13, 18, 22

(iii) 10, 4, 9, 7, 3, 4, 9, 7, 3, 0, 9

(4)    The following multi-bar graph has been constructed by collecting information about the number of male members and female members in five families in a certain village.



Using the above graph answer the following questions.

(i)    What is the total number of members in these five families?

(ii)    What is the family having the least number of males? Accordingly, what is the minimum value of the number of male members?

(iii)   What is the family having the maximum number of males? Accordingly, what is the maximum value of the number of male members?

(iv)   What is the range of the male members in the five families?

(v)    What is the range of the female members in the five families?

(vi) If two female members and two male members from each family can be members of a certain society which includes small children and elders, how many members from these families can obtain membership of this society?

### Summary

★ Data obtained from an experiment can be included in order in a table.

★ Such data can be represented in a cartesian plane with **bar-graphs** parallel to the vertical axis or to the horizontal axis.

★ When data that has to be represented with respect to an axis exceeds more than one group, **multi-bar graphs** are used.

★ **Stem and leaf diagrams** are used to facilitate representing data in order, when data received from experiments are not in an order.

★ The difference between the highest value and the lowest value of a set of data is its **range.**

★ The measurements, maximum value, minimum value and the range can be used in the interpretation of data.